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NAVFAC

UFGS-L-15080N (August 2003)

Preparing Activity: LANTNAVFACENGCOM

Superceding

UFGS-L-15080N (April 2003)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

Use for LANTNAVFACENGCOM projects only

Revised throughout - Format changes and reference dates not indicated by  
CHG tags. Other revisions are indicated by CHG tags.

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#### SECTION 15080N

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08/03

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### SECTION 15080N

#### MECHANICAL INSULATION

08/03

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NOTE: This guide specification covers the requirements for field-applied mechanical insulation for mechanical systems including heating, ventilation, and cooling (HVAC) equipment, ducts, and piping which is located within, on, under, and adjacent to buildings; and for plumbing systems.

NOTE: Suggestions for improvement of this specification will be welcomed using the Navy "Change Request Forms" subdirectory located in SPECSINTACT in Jobs or Masters under "Forms/Documents" directory or DD Form 1426. Suggestions should be forwarded to:

Atlantic Division  
Naval Facilities Engineering Command  
Attention EICO  
1510 Gilbert Street  
Norfolk, VA 23511-2699

FAX: (757) 322-4416 or DSN 262-4416

Email: LantDiv@efdlant.navfac.navy.mil

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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## PART 1 GENERAL

### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the

basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 209	(2002; Rev A.) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2002; Rev A.) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C 533	(2003) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(2003) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(2003) Mineral Fiber Preformed Pipe Insulation
ASTM C 552	(2000) Cellular Glass Thermal Insulation
ASTM C 553	(2002) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 591	(2001) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 612	(2000) Mineral Fiber Block and Board Thermal Insulation
ASTM C 1126	(2000) Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
ASTM C 1136	(2003) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM D 1784	(2002) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM E 84	(2003: Rev A.) Surface Burning Characteristics of Building Materials

## 1.2 SYSTEM DESCRIPTION

Provide [new][ and modify existing] field-applied mechanical insulation for mechanical systems [and existing insulated mechanical systems affected by the Contractors operations]. Mechanical systems include heating, ventilating, and cooling equipment, ducts, and piping which is located within, on, under, and adjacent to buildings; and for plumbing systems. Obtain Contracting Officer's written approval of each system before applying field-applied insulation. Provide new asbestos-free insulation materials.

## 1.3 SUBMITTALS

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NOTE: Where a "G" in submittal tags follows a  
submittal item, it indicates Government approval for  
that item. Add "G" in submittal tags following any  
added or existing submittal items deemed  
sufficiently critical, complex, or aesthetically  
significant to merit approval by the Government.  
Submittal items not designated with a "G" will be  
approved by the QC organization.  
\*\*\*\*\*

Submit the following in accordance with Section 01330, "Submittal  
Procedures."

SD-03 Product Data

Piping insulation and jacket  
Duct insulation and jacket  
Equipment insulation and jacket  
Boiler stack insulation and jacket

[SD-07 Certificates]

[Field Insulation Inspector; G]

[SD-08 Manufacturer's Instructions]

[Piping insulation/jacket installation]  
[Duct insulation/jacket installation]  
[Equipment insulation/jacket installation]  
[Boiler stack insulation/jacket installation]

[SD-09 Manufacturer's Field Reports]

[Piping insulation/jacket; G]

1.4 IDENTIFICATION OF NEW ASBESTOS-FREE INSULATION

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NOTE: Do not use for new buildings or existing  
buildings with no asbestos insulation.  
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Identify new asbestos-free insulation with "ASBESTOS-FREE" markings spaced  
at maximum of 6.1 m 20 foot intervals on the insulation jacket. Indicate  
the limits of new asbestos-free insulation with 51 mm2 inch wide orange  
bands with attached arrows pointing in the direction of the "ASBESTOS-FREE"  
markings.

PART 2 PRODUCTS

2.1 PIPING INSULATION AND JACKET

#### 2.1.1 Mineral Fiber Preformed Pipe Insulation

ASTM C 547. Provide piping insulation jacket.

#### 2.1.2 Rigid Cellular Phenolic Preformed Pipe Insulation

ASTM C 1126. Provide piping insulation jacket.

#### 2.1.3 Cellular Glass Preformed Pipe Insulation

ASTM C 552. Provide piping insulation jacket.

#### 2.1.4 Flexible Cellular Preformed Pipe Insulation

ASTM C 534. Piping insulation jacket is not required.

#### 2.1.5 Polyisocyanurate Insulation

ASTM C 591. Provide piping insulation jacket.

#### 2.1.6 Piping Insulation Jacket

Provide manufacturer's standard fire-retardant vapor barrier jacket. Jacket shall be suitable for painting. Provide factory prefabricated one-piece PVC insulation covers and mineral fiber insulation inserts of the same thickness as piping insulation for fittings, valves, and flanges.

#### 2.1.7 Polyvinylidene Chloride Polymer Film (PVDC)

ASTM C 1136. PVDC film may be used in lieu of standard piping insulation jacket. PVDC film provided shall meet or exceed the permeance of the manufacturer's standard jacket

#### 2.1.8 Aluminum Jacket

ASTM B 209/ASTM B 209, Temper H14, minimum thickness of 0.41 mm (0.016 inch), with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface aluminum jackets for insulation outside diameters less than 204 mm (8 inches). Provide corrugated surface aluminum jackets for insulation outside diameters 204 mm (8 inches) and larger. Provide stainless steel bands, minimum width of 13 mm (0.5 inch). Provide factory prefabricated aluminum insulation covers for fittings, valves, and flanges.

#### [2.1.9 PVC Jacket

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**NOTE: NOTE: Use bracketed paragraph if project site ambient design wet bulb temperature is below 21 degrees C (70 degrees F) for summer design conditions, i.e., a site of low humidity. This jacket may be a Contractor's choice that is provided covering mineral fiber piping insulation.**  
\*\*\*\*\*

ASTM D 1784, PVC jacketing, pre-cut and curled, 20 mil thick, white UV-resistant, and flame/smoke rating of 25/50 in accordance with ASTM E 84. All joints and seams shall be solvent welded in accordance with manufacturer's recommendations. Tacks and staples will not be allowed.

## ]2.2 DUCT INSULATION AND JACKET

### 2.2.1 Blanket Mineral Fiber Duct Insulation

ASTM C 553. Provide duct insulation jacket.

### 2.2.2 Rigid Mineral Fiber Duct Insulation

ASTM C 612. Provide duct insulation jacket.

### 2.2.3 Duct Insulation Jacket

Provide manufacturer's standard fire-retardant vapor barrier jacket.  
Jacket shall be suitable for painting.

### 2.2.4 Weatherproof Duct Insulation

ASTM C 591, rigid cellular polyurethane thermal preformed board insulation;  
or ASTM C 1126 rigid cellular phenolic thermal preformed board insulation.

## 2.3 EQUIPMENT INSULATION AND JACKET

Provide insulation for pumps, expansion tanks, condensate receivers,  
converters, and hot domestic water storage tanks.

### 2.3.1 Mineral Fiber Block and Board Insulation

ASTM C 612, minimum density of 96 kg per cubic meter 6 pcf.

### 2.3.2 Cellular Glass Block and Board Insulation

ASTM C 552, minimum density of 96 kg per cubic meter 6 pcf.

### 2.3.3 Calcium Silicate Block and Board Insulation

ASTM C 533.

### 2.3.4 Polyurethane Block and Board Insulation

ASTM C 591.

### 2.3.5 Phenolic Block and Board Insulation

ASTM C 1126.

### 2.3.6 Equipment Insulation Jacket

Provide manufacturer's standard fire-retardant vapor barrier jacket.  
Provide equipment insulation with aluminum jacket or waterproof aluminum  
pigmented mastic as recommended by the insulation manufacturer.

## 2.4 BOILER STACK INSULATION AND JACKET

Provide insulation for hot stacks (vents) within buildings.

### 2.4.1 Mineral Fiber Preformed Pipe Insulation

ASTM C 547, minimum density of 96 kg per cubic meter 6 pcf.

#### 2.4.2 Calcium Silicate Preformed Pipe Insulation

ASTM C 533.

#### 2.4.3 Aluminum Jacket

ASTM B 209MASTM B 209, Temper H14, minimum thickness of 0.41 mm 0.016 inch, with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide corrugated surface aluminum jackets. Provide stainless steel bands, minimum width of 13 mm 0.5 inch. Provide factory prefabricated aluminum insulation covers for fittings.

### PART 3 EXECUTION

#### 3.1 INSTALLATION OF MECHANICAL INSULATION

Clean exterior of mechanical systems prior to the application of field-applied insulation. Install field-applied insulation in accordance with the manufacturer's recommendations and as specified herein.

The completed installation shall have a fire hazard rating in accordance with ASTM E 84; flame-spread rating shall not exceed 25 and smoke developed rating shall not exceed 50 except as specified herein; smoke developed rating shall not exceed 150 for polyurethane insulations.

Insulation shall be clean and dry when installed and prior to the application of jackets and coatings. Do not use short pieces of insulation materials where a full length section will fit. Provide insulation materials and jackets with smooth and even surfaces, with jackets drawn tight, and smoothly secured on longitudinal laps and end laps. Insulate fittings and piping accessories with premolded, precut, or field fabricated insulation of the same material and thickness as the adjoining pipe insulation.

Provide unions, flanges, and piping accessories with readily removable sections of insulation and jacket. Provide insulation continuous through pipe hangers, pipe supports, pipe sleeves, wall openings, and ceiling openings, except at fire dampers in duct systems.

Provide a complete moisture and vapor seal wherever insulation terminates against hangers, anchors, and other projections through insulation on cold surfaces; fill joints, breaks, punctures, and voids with vapor barrier compound and cover with vapor sealed material. Do not conceal equipment nameplates. Cover ends of exposed insulation with waterproof mastic.

#### 3.2 PIPING INSULATION

Install field-applied insulation in accordance with the manufacturer's standard published instructions for piping insulation/jacket installation. Instructions shall apply to the particular piping system insulated. Generic generalized instructions shall not be acceptable. Comply with additional requirements specified herein.

Provide factory preformed pipe insulation. For insulation protection shields; provide rigid pipe insulation of the same thickness as adjacent pipe insulation and having a minimum compressive strength of 241 kPa 35 psi For piping 50 mm 2 inches and smaller, insulation having a minimum density of 112 kg/m<sup>3</sup> 7 pcf may be provided between the insulation protection



shields and the pipe.

Install insulation with joints tightly butted. Overlap longitudinal jacket laps not less than 38 mm 1.5 inches. Wrap butt joints with butt strips not less than 75 mm 3 inches wide of identical materials as jacket. Cement jacket laps and butt strips on both surfaces with fire-resistant, waterproof bonding adhesive or with factory-applied self-sealing system.

If vapor barrier jacket is pierced or punctured, brush coat with vapor barrier coating to provide a vapor-tight covering. If molded or mitered fitting covers are used, join with fire-resistant, waterproof bonding adhesive or wire in place and provide with a smooth coat of finishing cement. For copper tubing sizes one inch and less, pipe insulation for elbows, tees, and valves may be mitered.

### 3.2.1 Insulation for Water Piping

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**NOTE: For jobs located at Cherry Point and Camp  
LeJeune North Carolina use rigid Cellular phenolic  
on cold water piping. Choose the second bracketed  
paragraph in the following paragraph and  
subparagraphs for these locations. Choose the first  
bracketed paragraphs for other locations..**  
\*\*\*\*\*

[Provide mineral fiber preformed pipe insulation for heating hot water piping, hot and cold domestic water piping, roof drain piping, and cold drain piping. Rigid cellular phenolic or polyisocyanurate preformed pipe insulation having an insulating efficiency not less than that of the specified thickness of mineral fiber pipe insulation may be provided in lieu of mineral fiber pipe insulation.]

[Provide mineral fiber preformed pipe insulation for heating hot water piping and hot domestic water piping. Provide cellular glass or polyisocyanurate for cold domestic water, roof drain piping, and cold drain piping. Rigid cellular phenolic or polyisocyanurate preformed pipe insulation having an insulating efficiency not less than that of the specified thickness of mineral fiber pipe insulation may be provided in lieu of mineral fiber pipe insulation.]

#### 3.2.1.1 Heating Hot Water Piping, and Hot and Cold Domestic Water Piping

[Provide piping sizes less than 76 mm 3 inches with minimum of 25 mm 1 inch thick mineral fiber pipe insulation, except recirculating hot domestic water piping loop shall have minimum of 38 mm 1.5 inch thick mineral fiber pipe insulation. Pipe sizes of 76 and 102 mm 3 and 4 inches shall have minimum of 38 mm 1.5 inch thick mineral fiber pipe insulation. Pipe sizes 127 mm 5 inches and larger shall have minimum of 51 mm 2 inch thick mineral fiber pipe insulation. Rigid cellular phenolic or polyisocyanurate preformed pipe insulation having an insulating efficiency not less than that of the specified thickness of mineral fiber pipe insulation may be provided in lieu of mineral fiber pipe insulation.]

[Provide heating hot water and hot domestic water piping sizes less than 76 mm 3 inches with minimum of 25 mm 1 inch thick mineral fiber pipe insulation, except recirculating hot domestic water piping loop shall have minimum of 38 mm 1.5 inch thick mineral fiber pipe insulation. Pipe sizes of 76 and 102 mm 3 and 4 inches shall have minimum of 38 mm 1.5 inch thick

mineral fiber pipe insulation. Pipe sizes 127 mm 5 inches and larger shall have minimum of 51 mm 2 inch thick mineral fiber pipe insulation. Provide cold domestic water piping sizes less than 76 mm 3 inches with minimum of 38 mm 1.5 inch cellular glass pipe insulation. Pipe sizes of 76 and 102 mm 3 and 4 inches shall have minimum of 50 mm 2 inch thick mineral fiber pipe insulation. Pipe sizes 127 mm 5 inches and larger shall have minimum of 68 mm 2.5 inch thick mineral fiber pipe insulation.]

#### 3.2.1.2 Cold Drain Piping

[Provide minimum of 25 mm one inch thick [mineral fiber] [phenolic foam] [polyisocyanurate] pipe insulation. Do not insulate cold drain piping in crawl spaces or exposed to the weather.]

[Provide minimum of 25 mm one inch thick cellular glass or polyisocyanurate pipe insulation. Do not insulate cold drain piping in crawl spaces or exposed to the weather.]

#### 3.2.1.3 Roof Drain Piping

[Provide minimum of 25 mm one inch thick [mineral fiber] [phenolic foam] [polyisocyanurate] pipe insulation for horizontal roof drain piping above grade, underside of roof drain body, and vertical piping between roof drain body and horizontal roof drain piping.]

[Provide minimum of 25 mm one inch thick cellular glass or polyisocyanurate pipe insulation for horizontal roof drain piping above grade, underside of roof drain body, and vertical piping between roof drain body and horizontal roof drain piping.]

#### 3.2.1.4 Water Piping With Electric-Resistance Heater Cable

[Provide minimum of 50 mm 2 inch thick mineral fiber pipe insulation.]

[Provide minimum of 50 mm 2 inch thick cellular glass pipe insulation.]

#### 3.2.2 Insulation for Chilled Water Piping and Chilled-Hot Water Piping

\*\*\*\*\*  
**NOTE: For jobs located at Cherry Point, New River, and Camp LeJeune, North Carolina choose the second set of bracketed paragraphs. Choose the first set of bracketed paragraphs for other locations.**  
\*\*\*\*\*

[Provide rigid cellular phenolic preformed pipe insulation for chilled water piping and chilled-hot water piping. Provide piping sizes less than 50 mm 2 inches with minimum of 25 mm one inch thick rigid cellular phenolic pipe insulation. Provide piping sizes of 51 mm and 63 mm 2 and 2 1/2 inches with minimum of 38 mm 1.5 inch thick rigid cellular phenolic pipe insulation. Provide piping sizes 75 mm 3 inches and larger with minimum of 51 mm 2 inch thick rigid cellular phenolic pipe insulation.]

\*\*\*\*\*  
**NOTE: Check with the activity at job location before allowing the use of polyisocyanurate on any job. Do NOT use unless allowed by the activity.**  
\*\*\*\*\*

Cellular glass [or polyisocyanurate ]preformed pipe insulation having an insulating efficiency not less than that of the specified thickness of rigid cellular phenolic preformed pipe insulation may be provided in lieu of rigid cellular phenolic preformed pipe insulation.

For chilled water piping and chilled-hot water piping, the ends of pipe insulation and the space between the ends of pipe insulation and the piping shall be sealed off with waterproof vapor barrier coating at and around valves, fittings, flanges, unions, and in pipe runs at intervals not to exceed 4.57 mm 15 feet.

Minimum thickness of rigid cellular phenolic preformed pipe insulation exposed to the weather shall be increased by 25 mm one inch greater than the above thickness.]

[Provide cellular glass preformed pipe insulation for chilled water piping and chilled-hot water piping. Provide piping sizes less than 50 mm 2 inches with minimum of 38 mm 1.5 inch thick cellular glass pipe insulation. Provide piping sizes of 51 mm and 63 mm 2 and 2 1/2 inches with minimum of 50 mm 2 inch thick cellular glass pipe insulation. Provide piping sizes 75 mm 3 inches and larger with minimum of 68 mm 2.5 inch thick cellular glass pipe insulation. Rigid polyisocyanurate preformed pipe insulation having an insulating efficiency not less than that of the specified thickness of cellular glass pipe insulation may be provided in lieu of cellular glass pipe insulation. Polyisocyanurate shall not be grater than 1.5 inches38 mm thick.

Minimum thickness of cellular glass preformed pipe insulation exposed to the weather shall be increased by 25 mm one inch greater than the above thickness.]

### 3.2.3 Insulation for Refrigerant Suction Piping

Provide minimum of 19.1 mm 0.75 inch thick flexible elastomeric cellular preformed pipe insulation. Seal joints with waterproof vapor barrier adhesive. Cover joints with 38 mm 1.5 inch wide waterproof vapor barrier tape. Provide flexible elastomeric cellular insulation with two coats of white exterior acrylic emulsion paint.

### 3.2.4 Insulation for Steam Piping and Condensate Piping

Provide mineral fiber preformed pipe insulation. Minimum thickness of mineral fiber preformed pipe insulation exposed to the weather shall be 25 mm one inch greater than minimum thickness in the following table.

MINIMUM THICKNESS OF MINERAL FIBER PIPING INSULATION (MM)

Nominal Pipe Sizes (mm)	Steam Piping Insulation Thickness (mm)	Condensate Piping Insulation Thickness (mm)
up to 32	38	25
38 to 64	51	25
76 to 102	63	38
127 and larger	76	51

#### MINIMUM THICKNESS OF MINERAL FIBER PIPING INSULATION (INCHES)

Nominal Pipe Sizes (inches)	Steam Piping Insulation Thickness (inches)	Condensate Piping Insulation Thickness (inches)
up to 1.25	1.5	1.0
1.5 to 2.5	2.0	1.0
3 to 4	2.5	1.5
5 and larger	3.0	2.0

#### 3.2.5 Piping Insulation Covering

Provide piping insulation with piping insulation jacket.

#### 3.2.6 Piping Insulation Covering Exposed to the Weather

Provide piping insulation with aluminum jacket[, except for plastic foam preformed pipe insulation]. Machine cut the jacket to produce a straight, smooth edge. Lap longitudinal seams and circumferential seams not less than 51 mm 2 inches. Install jackets on horizontal piping with the longitudinal seam approximately midway between horizontal centerline and the bottom side of pipe. Install with the top edge of jacket overlapping the bottom edge of jacket and with the seam of each jacket slightly offset from the seam of the adjacent jacket. Install jackets on vertical piping and on piping pitched from the horizontal from low point to high point so the lower circumferential edge of each jacket overlaps the jacket below. Provide factory prefabricated covers for insulation on fittings, valves, and flanges. Finish jackets neatly at pipe hangers and pipe supports. Terminate jackets neatly at the ends of unions, valves, and strainers. Secure jacket with stainless steel bands spaced not more than 203 mm 8 inch centers.

### 3.3 DUCT INSULATION

Install field-applied insulation in accordance with the manufacturer's standard published instructions for duct insulation/jacket installation. Comply with additional requirements specified herein.

Provide duct insulation and jacket on exterior of supply ducts, return ducts, outside air intake ducts, and plenums, including metal on back of diffusers and registers. Apply insulation with joints tightly butted. Space pins or anchors at maximum of 305 mm 12 inch centers; secure insulation with washers and clips. Pins or anchors shall be metal electrically welded to duct surface or shall be metal attached to duct surface with waterproof adhesive especially designed for attachment to metal surfaces. Sagging of duct insulation will not be permitted. Insulation shall be tightly and smoothly applied to the ducts. Secure insulation to metal ducts with a fire-resistant, waterproof bonding adhesive applied in 102 mm 4 inch wide strips on 305 mm 12 inch centers. Provide minimum thickness of 38 mm 1.5 inches of rigid duct insulation in mechanical equipment rooms and where indicated. Provide minimum thickness of 51 mm 2 inches of blanket duct insulation in other locations. Both exterior duct insulation and acoustical duct lining are required when acoustical duct lining is indicated.

### 3.3.1 Blanket Duct Insulation

Secure to bottom of rectangular horizontal and sloping ducts more than 610 mm 24 inches wide, in addition to adhesive, by impaling over pins or anchors.

### 3.3.2 Rigid Duct Insulation

Secure to duct by impaling over pins or anchors located not more than 76 mm 3 inches from edge of insulation and spaced at maximum 305 mm 12 inch centers.

### 3.3.3 Vapor Barrier

Fill joints, breaks, punctures, and voids with vapor barrier coating compound and cover with vapor barrier jacket. At joints, the vapor barrier jacket for insulation shall be covered with 102 mm 4 inch wide pressure-sensitive vapor seal tape of material identical to jackets, or shall have 51 mm 2 inch wide laps drawn tight and secured with vapor seal adhesive. The joints and openings where the facing is pierced or punctured by pins, staples, or other means shall be brush coated with 51 mm 2 inch wide strips of vapor barrier coating compound.

## 3.4 WEATHERPROOF DUCT INSULATION

Provide minimum thickness of 74 mm 3 inches of rigid cellular polyurethane thermal preformed board insulation, or rigid cellular phenolic thermal preformed board insulation on exterior of supply ducts, return ducts, and plenums exposed to the weather.

Coat sides, ends, and edges of insulation with a waterproof mastic. Apply insulation in a solid bed of waterproof adhesive and additionally secure with one mm 20 gage galvanized metal studs welded to the metal ducts and having stainless steel washers not less than 51 mm 2 inches in diameter under the metal mechanical fasteners for bearing on the insulation and to hold the insulation in place.

Provide studs at the rate of one per 0.0929 square meters square foot of metal duct, spaced at maximum of 305 mm 12 inch centers along both edges of top, bottom, and sides of ducts and at joints in insulation.

After the insulation is in place, cover joints and corner joints, with glass fiber reinforcing mesh 305 mm 12 inches wide and continuous for the length of every joint; apply glass fiber reinforcing mesh in waterproof adhesive.

After covering is complete, coat exterior surfaces of insulation with an approved waterproof and weather-resistant aluminum pigmented mastic recommended by the insulation manufacturer for this type of application. Apply mastic in two equal coats to a minimum total thickness of 6.35 mm 0.25 inch; reinforce between coats with a layer of glass fiber reinforcing mesh; lap glass fiber reinforcing mesh 153 mm 6 inches at joints. Insulation less than 305 mm 12 inches in least dimension shall not be used along the edges of the duct bottom. Slope insulation from top center line of horizontal rectangular ducts to top edges of ducts with minimum slope of 83 mm per meter one inch per foot.

## 3.5 EQUIPMENT INSULATION

Install field-applied insulation in accordance with the manufacturer's standard published instructions for equipment insulation/jacket installation. Comply with additional requirements specified herein.

### 3.5.1 Pumps

Provide pumps with insulated metal casings properly shaped for a correct fit and designed for easy removal and replacement. Joints shall coincide with joints in each pump casing. Apply minimum thickness of 51 mm 2 inches of insulation in a solid bed of waterproof adhesive to exterior of metal casings. After the insulation is in place, coat exterior surfaces of insulation with an approved waterproof and weather-resistant aluminum pigmented mastic recommended by the insulation manufacturer for this type of application. Apply mastic in two equal coats to a minimum total thickness of 6.35 mm 0.25 inch; reinforce between coats with a layer of glass fiber reinforcing mesh; lap glass fiber reinforcing mesh 153 mm 6 inches at joints.

### 3.5.2 Expansion Tanks, Receivers, Converters, and Storage Tanks

Provide minimum thickness of 51 mm 2 inches of insulation for expansion tanks. Provide minimum thickness of 102 mm 4 inches of insulation for condensate receivers, converters, and hot domestic water storage tanks. Secure insulation with 1.613 mm No. 16 gage stainless steel or copper clad wire or 19.1 mm 0.75 inch wide 0.381 mm 0.015 inch thick stainless steel bands, each spaced on 305 mm 12 inch centers. Miter or cut insulation to ensure tight joints. Seal joints with insulating mastic. Provide insulation with 13 mm 0.5 inch thick hard-finish cement applied over zinc-coated wire netting. After the cement is in place, coat exterior surfaces of cement with an approved waterproof and weather-resistant aluminum pigmented mastic. Apply mastic in two equal coats to a minimum total thickness of 6.35 mm 0.25 inch; reinforce between coats with a layer of glass fiber reinforcing mesh; lap glass fiber reinforcing mesh 153 mm 6 inches at joints.

### 3.6 BOILER STACK INSULATION AND JACKET

Install field-applied insulation in accordance with the manufacturer's standard published instructions for boiler stack insulation/jacket installation. Comply with additional requirements specified herein. Provide minimum thickness of 102 mm 4 inches of insulation for boiler stacks inside of buildings. Provide insulation with aluminum jacket.

### 3.7 FIELD INSPECTIONS

Visually inspect the insulation installation of all mechanical systems to ensure that materials conform to requirements specified herein.

### [3.8 FIELD INSPECTIONS BY MANUFACTURER'S REPRESENTATIVE

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NOTE: Include this paragraph if project site  
ambient design wet bulb temperature is above 21  
degrees C 70 degrees F for summer design conditions,  
i.e., a site of relatively high humidity.  
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### 3.8.1 Field Insulation Inspector

The insulation systems field inspector shall be recommended in writing by the insulation system manufacturer. Personnel employed by the insulation subcontractor for installing insulation cannot serve as this insulation systems field inspector.

### 3.8.2 Field Inspection Reports

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**NOTE: In addition to systems using chilled water, include cold piping systems, systems with working temperatures of 4.5 to 10 Degrees C. 40 to 50 degrees F., for example, process systems. These inspection requirements do not apply to domestic cold water piping or cold condensate return piping.**  
\*\*\*\*\*

Provide field inspection of the piping insulation/jacket on [chilled water piping systems][chilled-hot water piping systems] [and \_\_\_\_]. Inspection shall be conducted by the approved insulation field inspector. The purpose of these inspections are for the insulation system manufacturer to verify that the designated insulation installations comply with manufacturer's standard published installation requirements.

Within 14 calendar days, submit a written report of the inspection describing what piping systems and subsystems were inspected. The system descriptions shall be such that the extent of the field inspection can be verified by reconciliation with the design drawings.

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-- End of Section --